

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-006514

(43)Date of publication of application : 09.01.2002

(51)Int.Cl.

G03F 7/38

H01L 21/027

(21)Application number : 2000-191364 (71)Applicant : CLARIANT (JAPAN) KK

(22)Date of filing : 26.06.2000 (72)Inventor : TAKANO YUSUKE
IJIMA ICHIYO
FUNATO SATORU
MURAKAMI YOSHIO
TANAKA HATSUYUKI

(54) DEVELOPMENT DEFECT PREVENTING PROCESS AND MATERIAL

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for forming a resist pattern, free of the deterioration of its pattern shape, such as a T-top and a round top caused by the influence of the processing atmosphere and the intermixture of surface coating and a resist and nonconforming particularly to a step of etching a chemical amplification photoresist, as well as to reduce development defects in a resist on a large diameter substrate of ≥ 8 inches in development.

SOLUTION: In the method for forming a resist pattern, a development defect reducing composition, e.g. comprising an acidic composition containing a surfactant is applied on a chemical amplification photoresist film formed on a substrate of ≥ 8 inches for preventing the formation of a layer which is hardly soluble in a developing solution on the surface of the resist as well, as to make the surface of the resist hydrophilic and to increase the reduction of the thickness of the chemical amplification photoresist film after exposure and development by 10-500 μm , by an appropriate degree of diffusion of an acid from the development defect reducing composition, as compared with the case where the composition is not coated.

LEGAL STATUS

[Date of request for examination] 04.07.2000

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3320402

[Date of registration] 21.06.2002

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

*** NOTICES ***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the constituent for development defective reduction used for the approach a development defect forms the resist pattern which has a good configuration few, and this approach using a chemistry magnification mold photoresist. Furthermore, it is related with the constituent for development defective reduction used for the formation approach of the resist pattern which can prevent generating of a development defect and can form a resist pattern with a good configuration over developing negatives after exposing in detail the diameter substrate of macrostomia with which the chemistry magnification mold photoresist film was formed, and forming a resist pattern throughout the diameter substrate of macrostomia, and this approach.

[0002]

[Background of the Invention] In manufacture of a semiconductor device, after forming the photoresist film on substrates, such as a silicon wafer, and irradiating an activity beam of light alternatively at this, a development is performed and the lithography technique which forms a resist pattern on a substrate is applied.

[0003] In order to obtain a higher degree of integration in LSI in recent years, detailed-ization of the processing line breadth in a lithography process is advanced quickly. It faces advancing detailed-ization of this processing line breadth, and various proposals are made about all processes including lithography, such as a photoresist, an antireflection

film, the exposure approach, an aligner, a developer, the development approach, and a developer, and the material of construction. For example, the surface antireflection film containing the fluorine content compound which is a low refractive index is prepared on a resist layer, and it is indicated by the patent No. 2643056 official report and JP,7-181685,A that this prevents the bad influence to the resist pattern formation by the reflected light from a resist front face. Even when the antireflection film was prepared on the resist layer, the width of face of the amplitude of a resist thickness pair sensitivity curve becomes small and the thickness of a resist layer varies, there is an advantage said that sensibility dispersion becomes small, as a result dimension dispersion becomes small. Moreover, when the surface antireflection film is used, it has the advantage which can reduce the standing wave by interference of incident light, the reflected light, or the reflected lights. In these days, flattening of a substrate substrate is performed and the device which forms the resist pattern of desired line breadth, without preparing the surface antireflection film, such as pressing down dimension dispersion by the above thickness dispersion, or tuning a mask pattern finely beforehand according to dimension dispersion of a resist, is also made.

[0004] About an aligner, further, far ultraviolet rays, such as the process using the source of short wave Nagamitsu effective in a raise in detailed, i.e., a KrF excimer laser, (248nm), and an ArF excimer laser (193nm), and the approach using an X-ray and an electron ray as the exposure light source are proposed, and a part is being put in practical use.

[0005] On the other hand, the improvement in the yield in semiconductor integrated circuit manufacture is attracting the interest as a very important problem. Although there are many factors which determine the yield, poor formation of the pattern at the time of forming a pattern by the resist is raised as the cause. Defects with **, such as degradation of the resist by the suspension chemical species in what originates in the dust adhering to the inside of a resist or a resist front face as a cause of poor formation of this resist pattern, and a clean room, and a resist, and poor development are raised. For example, the process using a chemistry magnification mold photoresist as an example of degradation of the resist by the suspension chemical species in a clean room is raised. In order to influence a chemistry magnification mold photoresist sensitively in this process of the acid which exists in an ambient atmosphere, an alkali, and moisture, The neglect time amount from exposure to PEB (post exposure BEKU) becomes long, or by INTAMIKKUSU with a resist In the case of a positive type photoresist, the configuration of a resist pattern turns into a T character mold configuration (T-top), in the case of a negative-mold photoresist, it becomes roundish [wore] (round top), or there is a problem which dimension fluctuation of a pattern generates.

[0006] Moreover, it is at issue also about the defect at the time of resist film development in recent years, and Rhine and Society for Cutting Up Men in a tooth-space system resist, and poor opening in a contact hole system resist are mentioned. Although some causes of poor opening of a contact hole are considered, poor opening by the residue after development is the most common especially. As a cause of these defects (defect), in case a developer contacts a resist film surface, the contact to the resist film surface of the developer which uses water as a principal component is inadequate, and the dissolution to the developer of the exposure section is not fully performed, but it is raised that the part which should originally carry out opening becomes poor opening. Moreover, it is also

considered that the refractory object to a developer carries out the reattachment to a resist front face at the time of the water rinse after development.

[0007] Furthermore, in order to make it detailed, it is necessary to raise the contrast of a resist. Generally, in order to raise the contrast of a contact hole system resist, for example, in a positive type chemistry magnification mold photoresist, the technique of gathering the rate of protection of the hydrophilic radical of the polymer which is a principal component is used. However, if the rate of protection is gathered, a film surface will tend to become hydrophobicity and the wettability of a developer will also fall.

[0008] Various examination is performed in order to solve the above problems. For example, to JP,9-246166,A, plasma treatment of the photoresist front face is carried out, it is changed to a hydrophilic property, this improves the wettability of the resist to a developer to it, and the proposal which reduces a development defect is made. However, by this approach, the equipment installation for newly carrying out plasma treatment is needed, and the fall of a throughput poses a problem further.

[0009] Moreover, many attempts which reduce a development defect are also performed by optimizing a development sequence. For example, to JP,4-51020,B, an acetylene alcohol system surface active agent is added to a developer, the wettability of the developer to a positive resist is raised, and forming the pattern which does not have a development defect by this is indicated. the micro-machining by the above chemistry magnification mold photoresists of what can acquire a certain amount of effectiveness by this approach -- setting -- effectiveness -- enough -- ** -- ***** -- it is actual that it cannot say. Moreover, in order to prevent the development defect resulting from wettability lack of a developer, it is indicated by JP,61-179435,A that surface coating which raises wettability with a developer with the approach of adding a surface active agent to a developer and the approach of carrying out plasma treatment of the resist film front face may be performed.

[0010] However, when performing surface coating for reducing a development defect on the chemistry magnification mold photoresist film especially, the configuration of the pattern obtained as it is a constituent containing a basic compound will turn into T-top configuration so that deactivation of the acid in which the surface coating constituent by which coating was carried out in order to reduce this development defect acted as the exposure late-coming student may be carried out. On the other hand, when this surface coating gives a superfluous acid to a photoresist layer, in an unexposed part, extreme film decrease occurs and the resist pattern obtained has a possibility of becoming the round top configuration which causes trouble in an etching process.

[0011] Furthermore, the problem of the thickness homogeneity generated by diameter-ization of macrostomia of substrates, such as a silicon wafer of these days, and developing uniformity is said to make detailed-ization difficult further. For example, the paddle developing-negatives method is conventionally adopted as the development of the resist film on a silicon wafer widely. In paddle development, a developer is dropped on the resist film on a substrate, by carrying out the spin of the substrate, the thin film of a developer is formed throughout the resist film, and development is performed. However, at this time, in the core and the periphery section of a wafer, a difference arises in peripheral speed actually, a difference arises at the rate of a film surface by this, and a difference arises on the development conditions in a wafer core and the periphery section. In case the diameter substrates of macrostomia above 8 inches are processed at this time,

using a chemistry magnification mold photoresist especially as a resist, in the case of processing of the resist film on the conventional substrate 6 inches or less, generating of the development defect of the periphery section seldom seen may take place.

[0012] Therefore, for the improvement in the yield in semiconductor integrated circuit manufacture etc., while aiming at reduction of the development defect at the time of development including the development defect of the chemistry magnification mold photoresist of the substrate periphery section accompanying diameter [of macrostomia]-izing of substrates, such as a silicon wafer, the formation approach of a resist pattern that the pattern of defects of shape, such as the after [development] T-top or the round top, be form be strongly demand in order to correspond to detailed-ization of a resist pattern.

[0013]

[Problem(s) to be Solved by the Invention] especially this invention aim at offer the constituent for development defective reduction use for the formation approach of the resist pattern which do not cause degradation of pattern configurations , such as the inconvenient T - top and the round top , at the etching process which the development defect of the chemistry magnification mold photoresist at the time of the development in the diameter substrate 8 inches or more of macrostomia be reduce , and be cause by the effect of a processing ambient atmosphere , INTAMIKKUSU of surface coating and a resist , etc. , and this approach in view of the above situations .

[0014]

[Means for Solving the Problem] As a result of performing research and examination wholeheartedly, this invention persons on the chemistry magnification mold photoresist film formed on the substrate In the pattern formation approach of exposing and developing negatives and obtaining a resist pattern after applying the constituent for development defective reduction and carrying out hydrophilization of the front face By enlarging more film loss in quantity of the resist after development compared with the case where the constituent for development defective reduction is not carried out with **, it results that the above-mentioned purpose can be attained in a header and this invention.

[0015] Namely, the process at which this invention forms the chemistry magnification mold photoresist film with ** on a substrate 8 inches or more, The process which applies the constituent for development defective reduction on said chemistry magnification mold photoresist film, The process [BEKU / at least / process / after one of processes] of the process which applies the process which forms said chemistry magnification mold photoresist film with **, and said constituent for development defective reduction, The process which exposes said chemistry magnification mold photoresist film alternatively, and the process [BEKU / process / after exposing said chemistry magnification mold photoresist film], It is the formation approach of the resist pattern characterized by enlarging 10 moreA - 500A of decrements of the thickness of said chemistry magnification mold photoresist after a development compared with the case where the constituent for development defective reduction is not carried out with **, including the process which develops said chemistry magnification mold photoresist film.

[0016] Moreover, the process at which this invention forms the chemistry magnification mold photoresist film with ** on a substrate 8 inches or more, The process which forms the constituent for development defective reduction on said chemistry magnification mold photoresist film, The process [BEKU / at least / process / after one of processes] of the process which forms the process which forms said chemistry magnification mold

photoresist film with **, and said constituent for development defective reduction, The process which exposes said chemistry magnification mold photoresist film alternatively, and the process [BEKU / process / after exposing said chemistry magnification mold photoresist film], Are used for the formation approach of the resist pattern which enlarges 10 moreA - 500A of decrements of the thickness of said chemistry magnification mold photoresist after a development compared with the case where the constituent for development defective reduction is not carried out with ** including the process which develops said chemistry magnification mold photoresist film. It is the constituent for development defective reduction which consists of an acid constituent containing a surfactant.

[0017] Hereafter, this invention is further stated to a detail. the resist pattern formation approach of this invention -- if it is, it is required to enlarge 10 moreA - 500A of decrements of the thickness of said chemistry magnification mold photoresist after a development compared with the case where the constituent for development defective reduction is not carried out with ** on the chemistry magnification mold photoresist film. In this invention, a chemistry magnification mold photoresist may be which thing of a positive type and a negative mold. What contains a surface active agent in the constituent for development defective reduction in this invention is desirable, and when a chemistry magnification mold photoresist is a positive type, that whose constituent for development defective reduction is acidity is used preferably. As for the acid condition of this constituent, it is desirable that it is pH 1.5-4.5, and it is still more desirable that it is 1.7-3.5. Moreover, when a chemistry magnification mold photoresist is a negative mold, what is the acescence thru/or alkalinity is used preferably.

[0018] As a surfactant used for the constituent for development defective reduction of this invention, the organic acid used industrially, its amine, or ammonium salt is used preferably. As an organic acid, a functionality fluorocarbon compound is desirable. Also in a functionality fluorocarbon compound, the perfluoroalkyl carboxylic acid and its ammonium salt of C4-C15, A tetramethylammonium salt or the alkanolamine salt of C1-C4, The perfluoroalkyl sulfonic acid and its ammonium salt of C4-C10, A tetramethylammonium salt or the alkanolamine salt of C1-C4, The 4th class ammonium iodide of fluorination alkyl, a perfluoro adipic acid, and its quarternary ammonium salt are desirable. Further The perfluoroalkyl carboxylic-acid tetramethylammonium salt of C7-C10, the perfluoroalkyl sulfonic acid of C4-C8, and its alkanolamine salt of C1-C4 are desirable. What could use what was beforehand made into the salt, and mixed and formed bases, such as an organic acid, an amine, or ammonia, in the water solution is sufficient as the amine or ammonium salt of an organic acid.

[0019] They are used as a constituent for development defective reduction still more preferably 0.1 % of the weight to 25% of the weight, these surfactants being used as a water solution two to 4% of the weight. At this time, the mixed rate of bases, such as the above-mentioned organic acid, an amine, and ammonia, is prepared suitably, and it is desirable to consider the chemistry magnification mold photoresist or process conditions to be used, to prepare the basicity of a constituent etc., and to optimize film loss in quantity. Namely, for example, if it is the case where a positive type photoresist is used as a chemistry magnification mold photoresist In case a salt with an organic acid, an amine, or ammonium is used as a surfactant That what is necessary is to prepare these amounts of mixing and just to make it pH of the constituent for development defective

reduction turn into optimum pH of above-mentioned within the limits Or all surfactants consist of an organic acid at this time, it has become clear that a result superfluously desirable to that by which the constituent was made the thing of the range of Above pH using the organic acid is obtained compared with the equivalent of a base in many cases from that from which all serve as an amine of an organic acid or ammonium salt. Therefore, by adjusting suitably the mixed rate of bases, such as these organic acids, an amine, and ammonia, and this adjusting pH suitably according to the chemistry magnification mold photoresist used or process conditions, the film loss in quantity at the time of the development of a resist can be adjusted, and the optimal result can be obtained. as the constituent for development defective reduction applied to the chemistry magnification mold photoresist of a positive type -- the ratio of an organic-acid:base (for example, amine) -- a mole ratio -- it is -- usually -- 7:0 to about 7:6 -- it is -- desirable -- 7:4-7:6 -- it is before and after 7:5 still more preferably. moreover -- if it sees as an organic-acid:salt -- 7:0 to about 1:6 -- it is -- usually -- desirable -- 3:4-1:6 -- it is before and after 2:5 still more preferably.

[0020] Water soluble resin and various additives can be blended with the constituent for development defective reduction of this invention in the range which does not spoil the engine performance if needed. As water soluble resin used for the constituent for development defective reduction of this invention For example, Pori (vinyl alcohol), Pori (acrylic acid), Pori (vinyl pyrrolidone), Pori (alpha-trifluoro methylacrylic acid), Pori (vinyl methyl ether-KO-maleic anhydride), Pori (ethylene glycol-Co-op ROPIREN glycol), Pori (N-vinyl-pyrrolidone-KO-vinyl acetate), Pori (N-vinyl-pyrrolidone-KO-vinyl alcohol), Pori (N-vinyl-pyrrolidone-Koa krill acid), Pori (N-vinyl-pyrrolidone-Koa krill acid methyl), Pori (N-vinyl-pyrrolidone-KO-methacrylic acid), Pori (N-vinyl-pyrrolidone-KO-methyl methacrylate), Pori (N-vinyl-pyrrolidone-comber lane acid), Pori (N-vinyl-pyrrolidone-comber lane acid dimethyl), Pori (N-vinyl-pyrrolidone-KO-maleic anhydride), Pori (N-vinyl-pyrrolidone-KO-itaconic acid), Pori (N-vinyl-pyrrolidone-KO-itaconic-acid methyl), Pori (N-vinyl-pyrrolidone-KO-itaconic acid anhydride), a fluorination polyether, etc. are raised, and Pori (acrylic acid), Pori (vinyl pyrrolidone), a fluorination polyether, etc. are especially desirable.

[0021] Moreover, as an additive used for the constituent for development defective reduction of this invention, surfactants, such as a non-ion system surfactant added for the purpose of improvement in a property with ** etc., an anion system surfactant, and an amphoteric surface active agent, are raised, for example. As a non-ion system surface active agent, polyoxyethylene alkyl ether, For example, the polyoxyethylene lauryl ether, the polyoxyethylene oleyl ether, Polyoxyethylene fatty-acids diester, such as the polyoxyethylene cetyl ether, Polyoxy fatty acid monoester, a polyoxyethylene polyoxypropylene blockpolymer, an acetylene glycol derivative, etc. again as an anion system surfactant An alkyl diphenyl ether disulfon acid and its ammonium salt, or an organic amine salt, An alkyl diphenyl ether sulfonic acid and its ammonium salt, or an organic amine salt, Alkylbenzene sulfonic acid and its ammonium salt, or an organic amine salt, A polyoxyethylene-alkyl-ether sulfuric acid and its ammonium salt, or an organic amine salt, Alkyl sulfuric acid and its ammonium salt, or an organic amine salt is raised for 2-alkyl-N-carboxymethyl-N-hydroxyethyl imidazolinium betaine, a lauryl acid AMIDOPUROPURU hydroxy sulfone betaine, etc. as an amphoteric surface active agent.

[0022] Furthermore, as water used for the constituent for development defective

reduction of this invention, that from which organic impurities, a metal ion, etc. were removed is preferably used by distillation, ion exchange treatment, filtering, various adsorption treatment, etc.

[0023] In addition, it is also possible to use a meltable organic solvent for water with water for the purpose of improvement in spreading nature. If it is the solvent which dissolves in water 0.1% of the weight or more to water as a meltable organic solvent, there will be especially no limit, for example, polar solvents, such as ester, such as ketones, such as alcohols, such as methyl alcohol, ethyl alcohol, and isopropyl alcohol, an acetone, and a methyl ethyl ketone, methyl acetate, and ethyl acetate, dimethylformamide, dimethyl sulfoxide, methyl cellosolve, cellosolve, butyl cellosolve, a cellosolve acetate, butyl carbitol, and carbitol acetate, will be mentioned. the organic solvent which only gave these examples as an example of an organic solvent and which is not alike too much and is used by this invention is not restricted to these solvents.

[0024] Moreover, in this invention, optimization of film loss in quantity is good out of optimization by the constituent for development defective reduction also by preparation of the baking temperature of a resist and the constituent for development defective reduction, BEKU time amount, etc. Generally the prebaking temperature of a resist has two lines with the presentation. That is, one needs high energy and it has what [BEKU / generally / what / the temperature of about 100-150 degrees C], and the thing [BEKU / to this / thing / below 100 degrees C for which energy is not so required / compared with the above-mentioned thing]. Moreover, the prebaking temperature of the constituent for development defective reduction is 60-100 degrees C which is temperature sufficient generally to dry a solvent. Furthermore, generally BEKU after exposure of a resist is about 100-150 degrees C. For example, when T-top after development comes out, it may be able to realize as a combination of the baking temperature of a resist and a development defective constituent by making prebaking temperature of a resist into lowness and making prebaking temperature of the constituent for development defective reduction into height 100 degrees C or more. Moreover, film decrease to the extent that it causes un-arranging to etching can be reduced by exfoliating or dissolution removing the constituent for development defective reduction if needed after exposure.

[0025] 80-10000A of thickness of the constituent for development defective reduction in this invention is 330-990A still more preferably preferably that a chemical operation comes out enough and should just be a certain thickness so that film decrease may become large compared with the case where this constituent for development defective reduction is not applied. Moreover, spreading of the constituent for development defective reduction can be applied by the method of application of the arbitration known conventionally [, such as a spin coat,].

[0026] Moreover, as long as the chemistry magnification mold photoresist used as a resist in this invention is a well-known chemistry magnification mold photoresist, which thing of a positive type and a negative mold is sufficient as it. The thing of a large number including what consists of combination of the polymer and photo-oxide generating agent which protected polyhydroxy styrene by the t-butoxycarbonyl group, for example as a chemistry magnification mold photoresist of a positive type (H. Ito, C.G. Willson: Polym. Eng. Sci., 23, 1012 (1983) reference) is known. Moreover, as a chemistry magnification mold photoresist of a negative mold, what consists of alkali fusibility resin, a hexamethoxy melamine as a cross linking agent, and a photo-oxide

generating agent (for example, W.E. Feely, J.C. Imhof, C.M. Stein, T.A. Fisher, M.W. Legenza: Polym. Eng. Sci., 26, 1101 (1986) reference) is raised. The chemistry magnification mold photoresist of a positive type is [among these] desirable in this invention. Moreover, generally it is about 0.3-1.0 micrometers that what is necessary is just that to which the resist pattern obtained after also developing the thickness can respond to etching at an etching process suitably.

[0027] The pattern formation approach of this invention can be suitably applied, in case a pattern is formed on a substrate 8 inches or more. Although a silicon substrate is common as a substrate, of course, you may be what has film, such as oxide films, such as a metal membrane, oxidation silicon, silicon nitride, and acid silicon nitride, and a nitride, on silicon, and may be any of the substrate ingredient with which a substrate ingredient is not restricted to silicon, either and is conventionally used in the case of IC manufactures, such as LSI. Moreover, as long as BEKU of spreading of a chemistry magnification mold photoresist, the chemistry magnification mold photoresist film, and the constituent film for development reduction, the exposure approach, a developer, the development approaches, etc. are the thing or the conditions that using in case a resist pattern is conventionally formed using a chemistry magnification mold photoresist was known, they may be which things. Furthermore, the exposure light source used at an exposure process is also easy to be the thing of arbitration, such as ultraviolet rays, far ultraviolet rays, an X-ray, and an electron ray.

[0028]

[Example] Hereafter, although an example explains this invention more concretely, this invention is not limited at all by these examples. In addition, in the following examples, especially the "section" means the "weight section", if there is no reference.

[0029] The example 1 perphloro octane sulfonic acid 3 section, the 2-aminoethanol 0.35 section, and the polyvinyl-pyrrolidone 1 section of molecular weight 45,000 were dissolved in the pure-water 95.65 section at the room temperature at homogeneity, this was filtered through the 0.05-micrometer filter, and the constituent for development defective reduction was obtained. pH of this constituent for development defective reduction was about 2.3.

[0030] On a 8 inches silicon wafer, spreading thickness is changed, the positive type chemistry magnification mold photoresist containing p-hydroxystyrene derivative is applied, and the thickness after prebaking prepares the wafer shown in Table 1 about carried out to from 0.67 micrometers to 0.81 micrometers. 90 degrees C of prebaking were performed for 90 seconds at that time. Then, the above-mentioned constituent for development defective reduction was carried out with **, respectively so that thickness might become 440A (with no BEKU). Mask size was exposed using the halftone phase shift mask for contact holes which is 0.28 micrometers. Canon company make and FPA3000EX5 were used for exposure. Respectively, after performing PEB in 120 degrees C and 90 seconds, the development was carried out for 60 seconds with 2.38% of TMAH (tetramethylammonium hydroxide) developer. Here, development used E2 nozzle and used the software impact method. The inside of the obtained pattern, 0.20 micrometers of diameters of a hole; the diameter of a hole: The distance between holes observed the pattern of 1:1, 1:3, and 1:5 in Hitachi CD-SEM and S9200. The result is shown in Table 1. It is shown that opening of all the hole patterns with which front Naka and "he has no problem" were formed is carried out with predetermined aperture.

[0031]
[Table 1]

表 1

現像欠陥低減用組成物あり(現像:ソフトインバクト)									
現像前膜厚 (nm)	現像後膜厚 (nm)	膜減量 (nm)	1:1		1:3		1:5		
			適正露光量 (mJ/cm ²)	パターン細さ	適正露光量 (mJ/cm ²)	パターン細さ	適正露光量 (mJ/cm ²)	パターン細さ	
669	603	66	14	問題無し	18	問題無し	19	問題無し	
682	618	64	13	問題無し	18	問題無し	18.5	問題無し	
688	622	66	13	問題無し	18	問題無し	19	問題無し	
698	632	66	12.5	問題無し	18	問題無し	19	問題無し	
705	639	66	12.5	問題無し	18.5	問題無し	19.5	問題無し	
716	649	67	12.5	問題無し	19.5	問題無し	20	問題無し	
730	662	68	13.5	問題無し	19.5	問題無し	20	問題無し	
740	671	68	14	問題無し	19	問題無し	20	問題無し	
750	682	68	14	問題無し	19	問題無し	20	問題無し	
760	691	69	13	問題無し	19	問題無し	19.5	問題無し	
772	702	71	12.5	問題無し	18.5	問題無し	20	問題無し	
783	711	72	13	問題無し	18.5	問題無し	21.5	問題無し	
794	722	73	13.5	問題無し	19	問題無し	21.5	問題無し	
807	736	72	14.5	問題無し	19.5	問題無し	21.5	問題無し	

[0032] Preparing the silicon wafer to which the thickness after BEKU was changed and which carried out the positive type chemistry magnification mold photoresist with ** like example of comparison 1 example 1, without carrying out with **, others exposed,

PEB(ed) and developed the constituent for development defective reduction like the example 1, and observed it in CD-SEM like the example 1. The result is shown in Table 2. Many development defects were observed as compared with the example 1. In addition, "those with poor opening" shows among a table that that the hole pattern has not carried out [that] opening with predetermined aperture exists.

[0033]

[Table 2]

表 2

現像欠陥低減用組成物無し(現像:ソフトインバクト)									
現像前膜厚 (nm)	現像後膜厚 (nm)	膜減量 (nm)	1:1		1:3		1:5		パターン観察
			適正露光量 (mJ/cm ²)	パターン観察	適正露光量 (mJ/cm ²)	パターン観察	適正露光量 (mJ/cm ²)	パターン観察	
674	632	42	12	問題無し	18.5	問題無し	21	問題無し	
681	641	40	14.5	問題無し	21	問題無し	23.5	問題無し	
692	649	43	17	問題無し	24	問題無し	25.5	問題無し	
701	658	44	18	問題無し	23.5	問題無し	26	問題無し	
711	667	44	17	開口不良有り	22.5	開口不良有り	23.5	開口不良有り	
716	670	46	16.5	開口不良有り	20.5	開口不良有り	21	開口不良有り	
728	683	45	12.5	開口不良有り	18	開口不良有り	19.5	開口不良有り	
739	694	45	12	問題無し	20.5	問題無し	21	問題無し	
749	703	46	14	問題無し	21	問題無し	23	問題無し	
759	714	46	16.5	問題無し	23	問題無し	25.5	問題無し	
771	725	46	18.5	問題無し	25	問題無し	26.5	問題無し	
782	736	46	17.5	開口不良有り	22.5	開口不良有り	25	開口不良有り	
793	747	47	14.5	開口不良有り	20.5	開口不良有り	21.5	開口不良有り	
806	759	47	12.5	問題無し	20	問題無し	20	問題無し	

[0034] The silicon wafer to which the thickness after BEKU was changed and which carried out the positive type chemistry magnification mold photoresist with ** was prepared like example of comparison 2 example 1, and the constituent for development defective reduction made development the spray method, without carrying out with **, and also was made to be the same as that of an example 1 exposure, PEB, and

development, and was observed in CD-SEM like the example 1. The result is shown in Table 3. Although it is the same paddle development as the example 1 of a comparison, and development conditions are severe compared with the software impact method, and an improvement of a development defect is made compared with the example 1 of a comparison even when it considers as the spray method which a development defect cannot produce easily, compared with an example 1, it turns out that an improvement of a development defect is inadequate.

[0035]

[Table 3]

表 3

現像欠陥低減用組成物無し(現像:スプレー)								
現像前膜厚 (nm)	現像後膜厚 (nm)	膜減量 (nm)	1:1		1:3		1:5	
			適正露光量 (mJ/cm ²)	パターン観察	適正露光量 (mJ/cm ²)	パターン観察	適正露光量 (mJ/cm ²)	パターン観察
667	632	35	11	問題無し	17.5	問題無し	19.5	問題無し
678	641	37	13	問題無し	20	問題無し	22	問題無し
684	649	35	15.5	問題無し	21.5	問題無し	23	問題無し
697	658	40	18	問題無し	24	問題無し	25.5	問題無し
708	667	41	17	問題無し	22	問題無し	23.5	問題無し
720	670	50	14	問題無し	19.5	開口不良有り	20	開口不良有り
731	683	48	12	問題無し	18.5	問題無し	20	問題無し
741	694	48	12	問題無し	19.5	問題無し	21	問題無し
752	703	49	14.5	問題無し	21	問題無し	22.5	問題無し
763	714	49	17	問題無し	22.5	問題無し	25	問題無し
771	725	46	18	問題無し	24	問題無し	26.5	問題無し
782	736	46	17	問題無し	22	開口不良有り	24	問題無し
794	747	47	14	開口不良有り	19.5	開口不良有り	20.5	開口不良有り
807	759	49	12	問題無し	19.5	問題無し	21	問題無し

[0036]

[Effect of the Invention] As explained in full detail above, when degradation of pattern configurations, such as T-top and the round top, is not caused and the magnitude of a substrate becomes a diameter of macrostomia 8 inches or more by the resist pattern formation approach of this invention, a resist pattern with a good configuration without a

development defect can be formed.

[Translation done.]

CLAIMS

[Claim(s)]

[Claim 1] The process which forms the chemistry magnification mold photoresist film with ** on a substrate 8 inches or more, The process which applies the constituent for development defective reduction on said chemistry magnification mold photoresist film, The process [BEKU / at least / process / after one of processes] of the process which applies the process which forms said chemistry magnification mold photoresist film with **, and said constituent for development defective reduction, The process which exposes said chemistry magnification mold photoresist film alternatively, and the process [BEKU / process / after exposing said chemistry magnification mold photoresist film], The formation approach of the resist pattern characterized by enlarging 10 moreA - 500A of decrements of the thickness of said chemistry magnification mold photoresist after a development compared with the case where the constituent for development defective reduction is not carried out with **, including the process which develops said chemistry magnification mold photoresist film. [Claim 2] The formation approach of the resist pattern characterized by being the acid constituent with which the constituent for development defective reduction contains a surface active agent in the formation approach of a resist pattern according to claim 1.

[Claim 3] In the formation approach of a resist pattern according to claim 2 a surfactant The perfluoroalkyl carboxylic acid and its ammonium salt of C4-C15, A tetramethylammonium salt or the alkanolamine salt of C1-C4, The perfluoroalkyl sulfonic acid and its ammonium salt of C4-C10, A tetramethylammonium salt or the alkanolamine salt of C1-C4, The formation approach of the resist pattern characterized by being at least one chosen from the group which consists of the 4th class ammonium iodide of fluorination alkyl, a perfluoro adipic acid, and its quaternary ammonium salt.

[Claim 4] The process which forms the chemistry magnification mold photoresist film with ** on a substrate 8 inches or more, The process which forms the constituent for development defective reduction on said chemistry magnification mold photoresist film, The process [BEKU / at least / process / after one of processes] of the process which forms the process which forms said chemistry magnification mold photoresist film with **, and said constituent for development defective reduction, The process which exposes said chemistry magnification mold photoresist film alternatively, and the process [BEKU / process / after exposing said chemistry magnification mold photoresist film], Are used for the formation approach of the resist pattern which enlarges 10 moreA - 500A of decrements of the thickness of said chemistry magnification mold photoresist after a development compared with the case where the constituent for development defective

reduction is not carried out with ** including the process which develops said chemistry magnification mold photoresist film. The constituent for development defective reduction which consists of an acid constituent containing a surfactant.

[Claim 5] The constituent for development defective reduction according to claim 4 characterized by being at least one chosen from the group which said surface active agent becomes from the perfluoroalkyl carboxylic acid of C4-C15 and its ammonium salt, a tetramethylammonium salt or the alkanolamine salt of C1-C4, the perfluoroalkyl sulfonic acid of C4-C10 and its ammonium salt, a tetramethylammonium salt or the alkanolamine salt of C1-C4, the 4th class ammonium iodide of fluorination alkyl, a perfluoro adipic acid, and its quarternary ammonium salt.